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Assessing Pragmatic Communication in Children with Down syndrome

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Abstract

Purpose: Successful communication depends on language content, language form, and language use (pragmatics). Children with Down syndrome (DS) experience communication difficulties, however little is known about their pragmatic profile, particularly during early school years. The purpose of the present study was to explore the nature of pragmatic communication in children with DS.

Method: Twenty-nine six-year-old children with DS were assessed, in the areas of 1) initiation, 2) scripted language, 3) understanding context and 4) nonverbal communication, as reported by children's parents via the Children's Communication Checklist-2 (Bishop, 2003). Additionally, the relationships between pragmatics and measures of vocabulary, nonverbal mental ability and social functioning were explored.

Results: Children with DS were impaired relative to norms from typically developing children in all areas of pragmatics. A profile of relative strengths and weaknesses was found in the children with DS; the area of nonverbal communication was significantly stronger, while the area of understanding context was significantly poorer, relative to the other areas of pragmatics assessed in these children. Relationships between areas of pragmatics and other linguistic areas, as well as aspects of vocabulary and social functioning were observed.

Conclusions: By the age of six children with DS experience significantly impaired pragmatic communication, with a clear profile of relative strengths and weaknesses. The study highlights the need to teach children with DS pragmatic skills as a component of communication, alongside language content and form.

Keywords: Communication, pragmatics, Down syndrome, social functioning, vocabulary, nonverbal cognitive ability

Learning Outcomes

- Obtain knowledge of the pragmatic profile of relative strengths and weaknesses in six-year-old children with Down syndrome, and the significant degrees of impairment in different sub-areas of pragmatics in these children relative to TD norms.
- Gain an understanding of the degree to which various other factors (vocabulary, nonverbal ability, and social factors) relate to different sub-areas of pragmatics in six-year-olds with Down syndrome.
- Understand the importance of teaching pragmatic aspects of communication to children with Down syndrome, alongside linguistic aspects.

Introduction

Communication involves the expression and sharing of information between people, via mediums such as speaking and gesture, providing a means for people to connect. Shared intentionality and cooperation are fundamental to human communication (Grice, 1969; Tomasello, 2010). During development, children's communication abilities strongly contribute to their ability to form social relationships, in turn impacting on well-being and self-esteem (Hartup, 1983; Hemphill & Siperstein, 1990; Leary, Tambor, Terdal, & Downs, 1995). Any communication difficulties can therefore have a considerable negative impact upon development in children (Hadley & Rice, 1991; Rice, Sell, & Hadley, 1991).

Children who have developmental disabilities are often at particular risk of experiencing communication difficulties, and specific communication profiles of relative strengths and weaknesses tend to be associated with given populations (Geurts & Embrechts, 2008; Laws & Bishop, 2003). The most prevalent developmental disability worldwide is Down syndrome (DS), with approximately 1 in every 737 live births affected (Parker et al., 2010). A characteristic cognitive profile tends to be observed in individuals with DS. Silverstein, Legutki, Friedman and Takayama (1982) found strengths in individuals with DS on tasks involving figural content, and tasks of a visual nature, relative to weaker performance on tasks involving semantic content, comprehension, social intelligence, and reasoning ability. The gap between individuals with DS and their typically developing (TD) peers in intellectual functioning has been found to increase over time (Carr, 1985; Patterson, Rapsey, & Glue, 2013), indicating that it may be valuable to target areas of difficulty early in development. A particular pattern of difficulty tends to be observed in the language domain in those with DS (see Chapman & Hesketh, 2001, for a review), with expressive language difficulties reported across numerous studies (e.g., Abbeduto et al., 2001; Chapman, 1997; Chapman, Seung, Schwartz, & Kay-Raining Bird, 1998). Receptive language skills tend to be less impaired

relative to expressive language abilities in those with DS (Abbeduto et al., 2003; Chapman, Schwartz, & Kay-Raining Bird, 1991). A less clear picture has been reported in the literature with regards to pragmatic communication in individuals with DS (see Abbeduto, 2008; Martin, Klusek, Estigarribia, & Roberts, 2009; Roberts, Price, & Malkin, 2007, for reviews).

Pragmatics refers to ones' use of and understanding of appropriate verbal and nonverbal language, in the communication context in which it occurs (Bishop, 1997). There is little existing research mapping out the landscape of pragmatic communication skills in age cohorts of children with DS, or exploring possible explanations behind their given profile. The primary aim of the current study was to determine the extent of any impairments or strengths in areas of pragmatic communication in six-year-old children with DS. A secondary aim was to explore various potential correlates of pragmatic communication in these children with DS. Understanding the pragmatic profile in this age group of children with DS allows us to determine whether certain areas of pragmatic communication need to be supported in children with DS in the early school years, to allow for successful communication. Additionally, understanding what underlies any pragmatic impairments in six-year-old children is important for the development of education and intervention routes in the early school years.

Measuring pragmatic communication skills and impairment

Effective communication requires appropriate language use, from turn taking, to staying on topic, as well as nonverbal behaviour such as giving appropriate levels of eye contact to a communication partner. The rules governing appropriate language use also vary depending on the situation one is in (Abbeduto, 2008; Clark, 2004; Ninio & Snow, 1999). For instance, while it may be appropriate for a child to shout out loud in a playground setting with their peers, this would not be appropriate behaviour at a doctor's appointment. Therefore the ability to adapt one's verbal and nonverbal language use from one situation to another is important for successful communication.

There are various verbal and nonverbal behaviours in children that are indicative of difficultly in mastering certain components of pragmatic communication. Bishop (1998) noted that various pragmatic difficulties in children are reported in clinical accounts, but are difficult to observe with traditional tests. Standardized tests such as the Test of Pragmatic Language (Phelps-Terasaki & Phelps-Gunn, 1992) involve showing the child pictures of situations and asking them to generate an utterance that is appropriate to explain the picture (see e.g., Volden & Phillips, 2010). However, as noted by Bishop (1998) children may show less impairment when provided with clear instructions regarding a concrete context, compared to how they might perform in natural settings. Observing children in their natural context is another option for researchers (Pellegrini, Symons, & Hoch, 2014). However, Bishop (1998) notes that how a child behaves or responds in a clinical test or an observation situation may not reflect a child's day to day pragmatic skills in different situations, and that behaviours reflective of pragmatic impairments might not occur within the time frame of the test session. Individuals who spend a lot of time with the child will be familiar with the child's abnormal communicative behaviours. Thus teacher or parental rating scales are particularly useful for assessing the nature of children's pragmatic profile (see e.g., Laws & Bishop, 2004).

In a study of children's communication, Bishop and Adams (1989) explored the features of language that led to a judgment of inappropriate language use (see also Adams & Bishop, 1989). Signs of inappropriate language use included providing too much or too little information, using scripted language, and problems using context for comprehending utterances; these findings informed Bishop's (1998) development of a Children's Communication Checklist (CCC) to distinguish between different types of language difficulties in children, including pragmatic difficulties.

Bishop (2003) developed a revised version of the Children's Communication Checklist (CCC-2) to identify communication difficulties in children, based on parental observation.

Along with assessing structural language and autistic traits, there are four components of pragmatic behaviour measured in the CCC-2, these are initiation (i.e., inappropriate initiation behaviours), scripted language (i.e., with scripted language use leading to inappropriate pragmatic communication), understanding of context, and nonverbal communication. Difficulties involving any of these areas will lead to poorer pragmatic communication. First, signs of inappropriate initiation include telling the listener information that they already know, talking to strangers, and asking someone for information when the information is already known. Second, scripted language refers to using phrases in inappropriate contexts, and/or a child repeating phrases said by an adult, as well as providing over-precise responses. Third, difficulties with context refer to poor understanding of how to interpret another individual's verbal or nonverbal communication, depending on the context in which it occurs i.e., understanding the meaning of what another individual says based on when, where and how they say it. Signs of poor understanding of context include being overly literal, and struggling to understand the meanings of words when they are used in an atypical context. Finally, poor nonverbal communication refers to problems using body language, such as the use of suitable levels of eye contact and facial expressions (e.g., smiling), and the interpretation of other individuals' body language, as well as gestures. In the current study we assess these four sub-areas of pragmatic communication in six-year-old children with DS.

Pragmatics in children with DS compared to those without DS

In a review, Abbeduto (2008) states that individuals with DS show delay in virtually all facets of pragmatic performance relative to typically developing (TD) children of matched chronological age (CA). When comparing those with DS to controls matched for mental age (MA), there appear to be particular strengths and weaknesses in different pragmatic sub-areas, relative to control groups. Given the delay in intellectual development associated with DS, mental age (MA) matched control groups often allow a somewhat fairer comparison.

In the area of **nonverbal communication**: Mundy, Sigman, Kasari and Yirmiya (1988) reported that infants with DS in fact display significantly better nonverbal communication skills such as turn taking, appropriate eye contact, and smiling, in comparison to MA-matched TD infants. Gesture use has also been highlighted as a strength in young children with DS in the pre-linguistic years, relative to MA-matched TD controls (Franco & Wishart, 1995). Nonverbal communication skills such as appropriate levels of smiling have also been reported as relatively stronger in the DS population compared to those with other developmental disorders matched for MA (Fidler, 2005; John & Mervis, 2010). However, as noted in a review by Abbeduto (2008), and shown by Fidler, Philofsky, Hepburn and Rogers (2005a), the use of nonverbal behaviour to request (i.e., pointing or using eye contact to direct the behaviour of another person) is an area of difficulty for pre-schoolers with DS relative to MA-matched TD peers. Hence, we cannot necessarily assume that nonverbal communication will be unimpaired in children with DS when they enter the school years. It is also important to keep in mind that there are likely to be greater demands upon children's pragmatic skills when they enter the school years, as they are surrounded with other children in a new structured classroom setting, and also in the playground setting where they are likely to be among children of various ages. The demands on children's pragmatic communication as they enter the early school years could affect how children with DS perform relative to their peers.

Regarding **inappropriate initiation:** Laws and Bishop (2004) assessed a group of individuals with DS (age range: 10;02-22;09 years) via the Children's Communication Checklist (CCC, Bishop, 1998), in comparison with TD controls (not strictly matched for MA, but considerably younger than the DS group: age range 4;11-6;8 years). The only pragmatic sub-area on which the group with DS did *not* show significant impairment relative to these TD controls was 'initiation'. Studies comparing those with DS to those with Fragile X syndrome or autism, of similar nonverbal MA, have also found that talking too much about a given topic

(an aspect of inappropriate initiation), is comparatively much rarer in those with DS (Losh, Martin, Klusek, Hogan-Brown, & Sideris, 2012; Roberts et al., 2007; Sudhalter, Cohen, Silverman, & Wolf-Schein, 1990).

It has also been shown that those with DS have strengths with regards to not speaking too much, and provide appropriate responses, relative to language-matched (for mean length of utterance) TD controls (Beeghly, Weiss-Perry, & Cicchetti et al., 1990; Leifer & Lewis, 1984). Other studies have found that the ability to initiate a topic of conversation or to provide elaboration, are poorer in those with DS relative to MA-matched TD groups (Landry, Garner, Pirie, & Swank, 1994; Tannock, 1988; Roberts et al., 2007). Martin et al. (2009) reviewed pragmatic research in a wider review of communication in DS; they noted that although individuals with DS tend to show little initiation or elaboration, the ability of those with DS to stay on topic and to provide clarification when requested was in line with that shown by MA-matched TD children (Coggins & Stoel-Gammon, 1982; Tannock, 1988). Hence, the strengths that children with DS show related to not speaking too much may in part reflect a degree of difficulty elaborating, or initiating. The degree to which children with DS show impairment or strength relative to TD controls may also vary over the course of their development. For instance, the Laws and Bishop (2004) study included adolescents, who may show a different profile of strengths or weaknesses than pre-schoolers with DS do, relative to TD controls.

Regarding **context**: Laws and Bishop (2004) found that use of conversational context was significantly poorer in those with DS (age range = 10;02 – 22;09 years) relative to younger TD children (age range = 4;11 – 6;8 years). Conversational context referred to understanding of language in various contexts e.g., understanding words when they are used in a different context to usual, or in a non-literal way. Even within a mainstream school environment, children with DS may spend less time interacting with peers relative to those without DS, as they are often taught one-to-one with a support assistant (Fox, Farrell, & Davis, 2004).

Potential limitations in experience may affect the ability to understand language across different contexts. More research is needed to determine whether difficulties understanding context are also experienced by children with DS in the early school years.

Finally, with regards to **scripted language**: in the Laws and Bishop (2004) study discussed above, they also found that the group with DS showed significantly more difficulty involving stereotyped conversation (i.e., showing more evidence of scripted language) than the younger TD group. However, the difference between the group with DS and the TD group for the scripted language subscale was not as large as the difference displayed for understanding of context. To our knowledge, excessive use of scripted language is not typically associated with DS. Nonetheless, there is very little research in this area to support a strong claim regarding scripted language use in children with DS.

The existing literature outlined above indicates that pragmatic communication in those with DS is in line with MA in some areas, but impaired in others. Even within areas, there appears to be some degree of variation, e.g., different nonverbal communication findings, depending on which component of nonverbal communication is assessed. What is clear, is that *overall* pragmatic communication is certainly not unimpaired in children with DS, even relative to MA. In order to incorporate appropriate types of support for pragmatic language within early communication intervention for children with DS, it is important to know what children's specific pragmatic strengths and limitations are when they enter the school years.

In a review of pragmatics research in DS carried out by Roberts et al. (2007), the authors discuss the mixed findings in the area, and suggest that further research needs to be carried out to explore pragmatics in those with DS at specific ages and developmental stages. Pragmatic abilities are argued to change over the course of development (Abbeduto et al., 2007) and with that the pragmatic profile may also change; this is a result of individuals' competence increasing and also reflects age-related changes in social environments and changing social demands.

Roberts et al. note that future research should also explore the effects of linguistic, cognitive and social factors upon pragmatics at given stages in development.

Factors Related to Pragmatic Communication in Children with DS

Knowledge about what other variables are related to the pragmatic profile in children with DS can inform plans for early stimulation and interventions related to pragmatic skills in this population. There is little existing research that we are aware of that assesses factors related to pragmatic communication in children with DS. However, three potential contributors to pragmatic communication, as touched on above, are linguistic skills, cognitive functioning, and social functioning (Roberts et al., 2007). Based on the limited pool of existing studies exploring the relationship between these variables and components of pragmatics in those with DS, or without DS, we outline below the relationships that we may expect to observe in six-year-olds with DS.

First, **expressive and receptive language** performance may be related to variance in pragmatic communication in children with DS. Mundy et al. (1988) found an association between expressive language and nonverbal object requesting (i.e., use of gestures toward an object out of reach in order to request it) in children with DS. In TD children, McCathren, Yoder and Warren (1999) also found that prelinguistic pragmatic communication and expressive vocabulary were related. Whether there is a relationship between pragmatics and expressive vocabulary in children with DS when they are entering the early school years is not so clear. Expressive language is an area of particular weakness in those with DS (Chapman, Seung, Schwartz, & Bird, 1998; Næss, Lyster, Hulme, & Melby-Lervåg, 2011) thus it is important to determine the extent to which such language difficulties may relate to other pragmatic aspects of communication.

Pragmatic difficulties such as talking too much to strangers, and telling people more information than they need to know, necessarily involve verbal language. Thus, it is also

particularly relevant to explore the extent to which expressive language may be related to communication associated with initiation (Bishop, 2003). Additionally, difficulties responding appropriately, e.g., asking a question to which the individual has already had the answer provided, may be related to comprehension (i.e., receptive language difficulties).

Second, children's **nonverbal cognitive ability** may also be related to pragmatic communication. A number of the areas of pragmatic communication reported as strengths in those with DS relative to MA-matched control groups reflect nonverbal communication, including use of eye contact, socio-communicative gestures, smiling, and also sharing attention with an adult, e.g., showing them something by pointing, and having an awareness of the adult's attention (Fidler, 2005; Fischer, 1987; Franco & Wishart, 1995; Mundy et al., 1988). Mundy, Kasari, Sigman and Ruskin (1995) noted that the development of nonverbal communication skills may reflect cognitive capacities for representational thought and the cognitive capacity to engage in planned action sequences. Previous research with children with DS has shown that their stage of cognitive sensorimotor development (e.g., conceptual object knowledge) is positively related to their degree of concurrent language skills, including nonverbal pragmatic communication skills (Greenwald & Leonard, 1979; Smith, & von Tetzchner, 1986). However, more research is needed, and it is important to explore whether such associations continue to exist as children with DS get older and enter the school years. Thus, general cognitive nonverbal ability may be expected to correlate positively with nonverbal pragmatic communication abilities in six-year-old children with DS.

A third factor that may be related to variance in pragmatic communication is children's **social functioning**. Children with better social functioning may have more opportunities to learn from experiences in different social settings, e.g., trips to theatres, museums, restaurants, for instance, due to better abilities to behave in a socially appropriate manner and attend to others. Odom et al. (1999) note that social competence allows children to participate in social

exchanges. Thus, social functioning may be related to developing a better understanding of how to communicate in different contexts through experience. We hypothesise that social functioning may therefore be related to children's understanding of context. In TD children, social-emotional and behavioural (e.g., hyperactivity) difficulties have been shown to be related to pragmatic difficulties (Farmer & Oliver, 2005; Green, Johnson, & Bretherton, 2014; Mackie & Law, 2010). Given the relationship between social functioning and pragmatic difficulties in TD children, we wanted to explore the extent to which social functioning may relate to pragmatic difficulties in children with DS.

Children with DS have recently been reported as having weaker social capabilities and more social problems in general than their nonverbal MA-matched peers (Næss, Nygård, Dolva, Ostad, & Lyster, 2016), thus, exploring the extent to which social functioning correlates with sub-areas of pragmatics will highlight the wider impact of their social capabilities and social problems, and inform us as to the relative importance of these, and the other two factors (language and cognitive ability) for different sub-areas of pragmatic performance.

The present study

The aim of the present study was to explore pragmatic communication and the pragmatic profile in children with DS entering the early school years. To get an overall picture of pragmatic communication in children with DS, we compared the profile of pragmatic communication, based on parental rating, in six-year-old children with DS to norms for TD children, on the basis of chronological age and nonverbal mental age. It was hypothesised that a pragmatic profile of relative strengths and weaknesses would be observed. Specifically, nonverbal communication was expected to be the strongest area of pragmatics for those with DS, while understanding of context on the other hand was expected to be a weaker area. While children with DS may not be expected to be in line with TD peers of the same CA, they may

however be in line with TD peers for some areas of pragmatics when accounting for MA, such as nonverbal communication and initiation.

In addition we explored whether relatively superior or inferior performance in different sub-areas of pragmatic communication were related to expressive or receptive language performance, nonverbal cognitive ability and/or social functioning. Exploring these relationships in children within a specific age group makes such findings particularly useful when considering the nature of pragmatics in the early school years, and the areas appropriate to target for early intervention in this population.

Method

Participants

This study is part of a larger longitudinal research project approved by the Norwegian research ethical committee (Næss, 2012). The original sample consisted of a national age cohort of children with DS (N=43) recruited through the National Habilitation Service. In this sub-study only those children who were able to speak in sentences were included, as the communication questionnaire used in the current study (Children's Communication Checklist-2 (CCC-2); Bishop, 2003) requires that children can use multiword utterances. This resulted in a final sample of N = 29 children (16 females, 13 males) in the current study (mean chronological age = 75.93 months, *SD* = 3.32 months, mean nonverbal mental ability raw score (Block Design; Wechsler, 2002) = 13.48, *SD* = 4.95, mental age equivalent of raw score = 2 years, 6 months – 4 years, 4 months). The other inclusion criteria which were met were as follows; the children should have no comorbid diagnosis of autism and at least one of their parents had Norwegian as his/her first language. All of the children in this study spoke Norwegian as their main language both at school and also at home. In this study children with DS were all six-years-old, thus removing the potential confound of a wide age range among the participants, which is common to other studies in this area. Assessing children's communicative

abilities at this age in Norway is particularly relevant since this is the age at which Norwegian children begin school. The findings should therefore have direct relevance to early interventions for kindergarten and the early school years. Targeting children's communication skills early in their development may allow them to build on these skills in the future.

Norwegian school policy is regarded as highly inclusive (Organisation for Economic Co-operation and Development [OECD], 2011), and children with DS are usually included in mainstream school. The extent to which different schools succeed in meeting the full range of students' needs within a mainstream classroom may vary (Engevik, Næss, & Berntsen, 2016). All of the children in the current study participated in ordinary education in Norway, with the exception of four children; one was in special school, two went to special education departments in ordinary schools and one went to a Steiner school (alternative to mainstream school, based on Rudolf Steiner's educational philosophy).

Procedure for Collecting Data

Two different data collection methods are reported in this paper; parental electronic questionnaires and clinical tests.

The mother or the father, or both parents in collaboration, answered electronic questionnaires; these were the Children's Communication Checklist (CCC-2; Bishop, 2003); the Paediatric Evaluation of Disability Inventory (PEDI; Haley, Coster, Ludlow, Haltiwanger, & Andrellos, 1992) and the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997).

In the clinical test session the children were assessed individually in a separate room in school. All expressive answers were registered manually and audio-taped. Norwegian versions of all measures were used. The measures included were the Expressive Picture Naming test (WIPPSI –III; Wechsler, 2002); the British Picture Vocabulary Scale (BPVS-II; Dunn, Dunn,

Whetton, & Burley, 1997), and the Block Design subtest from the standardized WPPSI III (Wechsler, 2002).

Measures

CCC-2. The CCC-2 aims to assess whether children have a general communication disorder, social interaction and deviance difficulties, and pragmatic communication impairments.

The CCC-2 is a questionnaire to be filled in by parents and consists of 70 items for the parent to rate, these items are divided into ten subscales. Four of the subscales assess language structure: these four components are, A. speech, B. syntax, C. semantics and D. coherence. A further four of the subscales assess areas related to pragmatic impairments, these are, E. inappropriate initiation, F. scripted language, G. use of context, and H. nonverbal communication. Finally, two subscales assess behaviours associated with autism, these are, I. social relations and J. interests. For each subscale there are seven items; five items assessing difficulties and two items assessing strengths. The respondent rates the frequency with which each behavior is observed in the child. Frequency ratings from 0-3 are given, 0 denotes less than once a week, 1 denotes at least once a week, 2 denotes once or twice a day, and 3 denotes several times (more than twice) a day.

With regards to the four pragmatic subscales of the CCC-2, inappropriate initiation refers to behaviours such as: ‘talks to people without any encouragement or starts conversations with strangers’, ‘tells people things they know already’, and ‘asks a question, even though he or she has been given the answer’. Scripted language is seen when an individual uses phrases in inappropriate contexts, and provides over-precise information, other examples from this subscale include ‘repeats phrases said by an adult’ (e.g., when asked ‘what did you eat’ repeats back ‘what did you eat’), and also ‘says things he or she does not seem to fully understand’. Signs of poor understanding of context include struggling to understand the meanings of words when they are used in an atypical context, examples from this subscale are: ‘ability varies from

situation to situation (e.g., talks easily one to one with a familiar adult, but has difficulty expressing himself or herself in a group of children)', and 'Is too literal (e.g., if told to 'watch your hands' while using scissors, proceeds to stare at his/her fingers)'. Finally, poor nonverbal communication refers to behaviours such as 'looks blank in a situation where most children would show a clear facial expression (e.g., when angry, fearful or happy)', 'does not look at the person he or she is talking to', and 'stands too close to other people when talking to them'. For further details regarding the CCC/CCC-2 items see Bishop (1998), Bishop (2003) and Helland, Biringer, Helland and Heimann (2009).

The CCC-2 has been standardized in the UK on 542 children aged 4-16 years old. Norbury, Nash, Bishop and Baird (2004) also carried out a validation study of the CCC-2 and found that it was successful in distinguishing between children with and without communication impairments, as intended. Cultural differences are important to consider when assessing language difficulties and comparing individuals' scores to standardized norms from a different country (Norbury & Sparks, 2013). Norwegian norms have been developed for the Norwegian adaptation of the CCC-2, using these norms allows us to make a fair comparison of the children with DS to norms for TD children in the current study. Helland et al. (2009) suggested that a slightly higher cut-off score may be needed to detect general communication impairment in the Norwegian version of the CCC-2, relative to the UK version, and they speculate that this may be due to cultural differences in pronunciation, where the use of dialects are cultivated and appreciated more so in Norway than in the UK. The Norwegian adaptation of the CCC-2 was assessed by Helland et al. (2009) showing that the Norwegian adaptation was also successful in differentiating children with communication impairments from those without communication impairments. The Norwegian CCC-2 also had reasonable internal consistency, in line with that reported for the UK standardization sample.

Expressive vocabulary. Expressive vocabulary was measured via a standardised expressive Picture Naming test (WIPPSI –III; Wechsler, 2002). The test is translated into Norwegian and normed for children aged 2.6-7.3 years. Children were presented with a sequence of pictures and were asked to name them. One point was given for every correct answer (articulation mistakes were overlooked). These scores were added to give a summary score. The test consisted of 38 items, with specified instructions regarding start and discontinuation points.

Receptive vocabulary. Receptive vocabulary was measured using the standardized British Picture Vocabulary Scale (BPVS-II; Dunn et al., 1997). The Norwegian version of the test is normed for children aged 3.0-16.1 years. For the BPVS-II the children were shown four pictures and were asked to point to the picture that corresponded to the stimulus word said by the examiner. One point was given for every correct answer. These scores were added to give a summary score. The test consisted of 144 items, again with specified instructions regarding start and discontinuation points.

Nonverbal Ability. The Block Design subtest from the standardized WPPSI III (Wechsler, 2002) was used to measure children's nonverbal cognitive ability. The test is translated into Norwegian and normed for children aged 2.6-7.3 years. The children were shown a pattern made by putting a set of coloured blocks in a certain arrangement, and were subsequently asked to recreate the pattern. As the test progresses the difficulty increases, with an increase in the number of blocks used to make the pattern. First, the pattern is shown to them physically using the blocks; further on in the test the pattern is shown to them via a two dimensional picture. For the first six items, the child got two attempts to get the model correct; if correct on the first attempt the children earned two points for each item, if correct on the second attempt the children earned one point. These scores were added to give a summary score. The test consisted of 20 items in total, with specified starting points and discontinuation rules.

Social functioning. The PEDI is a standardized structured parental interview instrument (Haley et al., 1992). The Norwegian version of the PEDI is normed for children aged 1.0-5.11 years, and was used to examine functional skills (e.g., the child's ability to function in daily life activities) in the social function domain. The social function domain includes 65 items in total, and these cover various subscales as follows: Comprehension of word meanings, Comprehension of sentence meanings, Functional use of Communication, Complexity of expressive communication, Problem-resolution, Social interactive play (with adults), Social interactions (with child of similar age), Play with objects, Self-information, Time orientation, Household-chores, Self-protection and Community. Items are scored either 0 (can perform) or 1 (unable). These scores were added to give a summary score. The internal consistency of the PEDI social function domain has been determined to be excellent (Cronbach's $\alpha = .98$) (Haley et al., 1992). In the present study, the internal consistency was indicated by Cronbach's $\alpha = .86$.

The SDQ is a standardised parental questionnaire (Goodman, 1997); this was additionally used to measure social problems, and a prosocial sub-factor was used to measure social capabilities. The Norwegian translation is normed for children aged 4-17 years. It includes 25 statements measuring five sub-factors, these are: 1. emotional symptoms, 2. conduct problems, 3. hyperactivity, 4. peer relation problems, and 5. prosocial behaviour. Each statement can be answered with not true, somewhat true, or certainly true, with ratings from 0-2, such that higher scores reflect increased difficulties for the first four subscales, and for the fifth subscale (prosocial behaviour) higher scores reflect fewer difficulties. These scores were added to give a summary score. The total parent-reported difficulty scores have a possible range of 0–40. Internal consistency for the total difficulties score has been found to be satisfactory (Goodman, 2001; Koskelainen, Sourander, & Kaljonen, 2000; Rønning, Handegaard, Sourander, & Mørch, 2004).

Data analysis

SPSS version 23 was used to analyze the data. The raw scores were converted into standardized scores to account for either children's age or children's nonverbal mental age in the data analyses. The CCC-2 scoring instructions include a consistency check to assess whether the raw scores for a subset of positively worded questions are consistent with corresponding negatively worded questions of the CCC-2; all values in the current data set met the CCC-2 consistency criteria. In accordance with the guidelines of the CCC-2, if two or more values were missing for a child on any subscale then this subscale value was removed from the analysis for the given child (Bishop, 2003, also reported in Helland et al., 2009). All of the statistics reported are based on parametric tests (*t*-tests, ANOVA and Pearson's *r* correlations). There was a degree of skew in the data, with potential floor effects for some children on subscales A and B of the CCC-2 (Speech and syntax). All analyses were repeated with non-parametric tests, leading to the same conclusions as the parametric tests reported. There were no outliers observed for any of the measures.

Results

Descriptive data for all 10 subscales of the CCC-2, and for each of the clinical tests are shown in Table 1. The four pragmatic subscales of the CCC-2 (subscales E, F, G and H) are in italics.

Table 1. Mean, standard deviation and range for subscales of the CCC-2 and each clinical test.

	Chronological age standardized score		
CCC-2 Subscales:	***M***	***SD***	**Range (Min – Max)**
A. Speech	1.93	2.25	0-7
B. Syntax	1.21	1.93	0-8
C. Semantics	4.71	1.27	2-7
D. Coherence	4.18	2.25	1-11
E. Initiation	5.48	1.50	3-10
F. Scripted language	5.75	2.88	1-13
G. Context	3.55	1.88	0-7
H. Nonverbal communication	6.79	1.63	4-10
I. Social relations	5.96	2.60	0-10
J. Interests	5.62	1.93	2-11
Clinical tests:			
Picture naming	11.72	4.07	3-20
BPVS	27.66	9.18	12-50
Nonverbal ability	13.86	4.78	3-22
SDQ	10.14	4.98	3-22
PEDI	35.00	4.99	20-42
SDQ prosocial	8.00	1.41	5-10

Note. Due to missing responses, N = 28 for subscale F (scripted language), subscale C (Semantics), subscale D (Coherence) and subscale I (Social Relations). For all remaining subscales N = 29. TD standard scores for each of the subscales of the CCC-2 had a normative mean of 10 (SD = 3).

Pragmatics in children with Down syndrome relative to norms for TD children

To compare scores on each pragmatic subscale in six-year-old children with DS to the norms for TD children of the same chronological age we first assessed whether the mean for the group with DS fell one standard deviation or more below the TD norm mean value (M = 10, SD = 3) for each subscale. As shown in Figure 1, across all subscales the mean standardized scores for children with DS (green bars) were 1 SD or more below the norm for TD children. Additionally, the mean score for the context subscale in the DS group fell more than 2 SD below the norm for TD children.

Next, to compare pragmatic skills in six-year-old children with DS to the norms for TD children of a similar MA, we derived the standard score for each individual with DS from the table of norms for TD children of the same MA (i.e., for a six-year-old child with DS with a MA of 4, their standardized score for each subscale was derived from the table of standardized scores for norms of TD children age 4 years). As performance in younger TD children is poorer than older TD children, using the norms for younger children to derive a standard score for each child with DS results in *higher* standard scores relative to their standard scores derived on the basis of chronological age. The lowest age norms available for the CCC-2 were age 4 years, thus for any children with DS with a nonverbal MA lower than 4 years this lowest set of age based norms had to be used. Descriptive data for the scores of children with DS when standardized on the basis of their MA are shown in Appendix A. As shown in Figure 1, when standardizing the scores for the DS group on the basis of their MA, their mean performance for each subscale (blue bars) fell below 1 SD of the TD norm for some subscales, but not others. The mean for the DS group for the nonverbal communication subscale now fell within 1 SD of the norm for TD children. Scores on the scripted language subscale fell exactly 1 SD from the TD norm, while scores on the initiation subscale fell just beyond 1 SD of the TD norm. Scores on the context subscale no longer fell beyond 2 SD of the TD norm.

To assess whether the distribution of scores for the DS group for each subscale were significantly lower than the established TD norm mean we also ran one sample t-tests. The p value criterion of .05 was divided by 4 to account for the four tests (one for each pragmatic subscale); we thus used a significance criterion of $p < .012$. First, when scores for the children with DS were standardized on the basis of chronological age, they scored significantly lower than the TD norm for each pragmatic subscale (initiation: $t(28) = -16.19$, $p < .001$, scripted language: $t(27) = -7.82$, $p < .001$, context: $t(28) = -18.45$, $p < .001$, nonverbal communication: $t(28) = -10.57$, $p < .001$). Second, with the scores for the children with DS standardized on the basis of their MA they remained significantly lower than the TD norm mean for each subscale (initiation $t(28) = -11.54$, $p < .001$, scripted language $t(27) = -5.98$, $p < .001$, context $t(28) = -15.73$, $p < .001$, nonverbal communication $t(28) = -8.45$, $p < .001$).

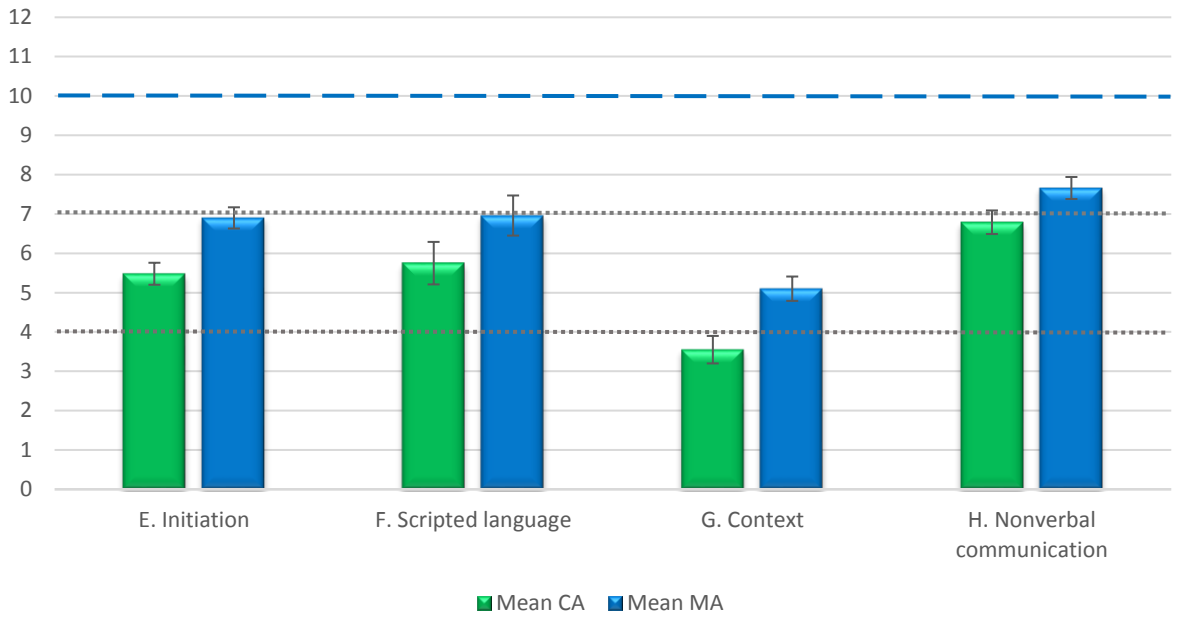

Figure 1. Means and standard error of standardized scores for children with DS (standardized on the basis of chronological age: green bars, and standardized on the basis of mental age: blue bars) for each pragmatic subscale of the CCC-2. Lowest possible performance is zero (maximum = 16). Mean for each subscale for TD standardized norms = 10, *SD* = 3. The blue line indicates the standardized mean for the norms of TD children, and the two grey dotted lines highlight 1 SD and 2 SD below the mean of the TD norms.

Pragmatic Profile

To determine whether the standardized scores of six-year-old children with DS differed significantly between the four different pragmatic subscales of the CCC-2, a one-way Analysis of variance (ANOVA) was carried out with pragmatic subscale as the within subjects factor with four levels (initiation, scripted language, context and nonverbal communication). The dependent variable was children's mean standardized score based on chronological age.

A significant main effect of subscale was observed, $F(3, 81) = 15.96$, $p < .001$, $\eta p^2 = .37$. Pairwise comparisons between each of the four subscales were subsequently carried out

with Bonferroni correction. Corresponding t-values for the pairwise comparisons were calculated for each of the Bonferroni corrected p-values. Pairwise comparisons that reached significance with Bonferroni correction were initiation and context, $t(28) = 4.15$, $p < .001$, initiation and nonverbal communication, $t(28) = 2.42$, $p = .022$, scripted language and context, $t(27) = 4.13$, $p < .001$, and nonverbal communication and context, $t(28) = 6.62$, $p < .001$, as apparent in Figure 1. There was no significant difference between initiation and scripted language ($p = .999$). Thus, with regards to pragmatic communication, significantly more difficulty was reported for children with DS regarding the context subscale, compared to the extent of difficulties reported on all three other pragmatic subscales. More difficulties were experienced regarding both initiation and scripted language compared to nonverbal communication difficulties; however the difference only remained significant after Bonferroni correction for initiation and nonverbal communication (as reported above), (scripted language and nonverbal communication: $t(27) = .54$, $p = .591$).

Linguistic vs. Pragmatic subscales

To determine whether structural language was significantly poorer than pragmatic communication in children with DS, a t-test was also carried out comparing the mean of the four combined language subscale mean scores based on CA (scales A-D), to the mean for the four combined pragmatic subscale mean scores, based on CA (scales E-H). Participants' mean scores across the pragmatic subscales was significantly higher than their mean scores across the combined structural language subscales, $t(27) = 8.89$, $p < .001$.

Relationships among CCC-2 subscales

For all correlations, the p value criteria of .05 was again corrected for test-wise error, dividing by 4 to account for the four pragmatic subscales. Thus a p value of .012 was used as a significance criterion.

Scores standardized on the basis of CA were used in all correlations. There were no significant correlations between initiation and the other pragmatic subscales, or between nonverbal communication and the other pragmatic subscales. There was a significant positive correlation between the scripted language and context subscales (r = .559, p = .002). Initiation and nonverbal communication were not significantly correlated with any linguistic subscales of the CCC-2. However, scripted language was significantly positively correlated with scores on the semantic subscale (r = .547, p = .003), as well as scores on the coherence subscale (r = .621, p < .001). Scores on the context subscale were significantly correlated with scores on the syntax subscale (r = .468. p = .010). A medium effect size correlation between context and coherence was observed, as well as a similar correlation between context and semantics, however these latter two correlations did not remain significant at the corrected p value criterion (p < .012). (A full table of correlation coefficients and corresponding p values is provided in Appendix B).

Relationships among the pragmatic subscales of the CCC-2 with vocabulary, nonverbal ability and social functioning

To further elucidate the relationship between pragmatics and other abilities in children with DS, correlations were next carried out among each of the pragmatic subscales with expressive vocabulary, receptive vocabulary, nonverbal ability, PEDI scores, SDQ scores and prosocial SDQ scores. Corresponding descriptive statistics for these variables are shown in Table 1.

None of the significant correlations between variables survived correction for multiple comparison. Based on the sample size that we have (N = 29) and the p value that we are using after correction, we would be sensitive to effect sizes of r = .458 and up. Traditionally a value of r = .5 is interpreted as a large effect (Cohen, 1988), while r = 3 to 5 is considered as a medium effect size. More recently, Gignac and Szodorai (2016) carried out a literature review on effect sizes in individual differences data and noted that less than 3% of correlations in the literature

are as large as $r = .50$, they thus recommend that researchers consider .10 (small), .20 (typical) and .30 as a relatively large effect.

While we have the power to detect large effects, we lack the power to detect small and medium effect sizes. There do not appear to be any correlations of large effect size in this dataset. There were a number of medium effect size correlations in the dataset. To ensure that we do not miss any potentially meaningful relationships that could be explored further in future research, we highlight below the medium effect sizes observed; however we must emphasise that these do not reach significance after correction (criterion: $p < .012$), and should thus be interpreted very tentatively. Correlations of a medium effect size were observed between SDQ scores and initiation ($r = .429$, $p = .020$) in a negative direction (higher SDQ scores reflect poorer performance, this correlation therefore reflects greater difficulties measured by the SDQ correlating with greater difficulties for the initiation subscale. There was also a negative correlation between SDQ scores and scripted language ($r = .423$, $p = .025$). There was a medium effect size negative correlation of receptive vocabulary and nonverbal communication ($r = .383$, $p = .040$), and also a medium effect size negative correlation of expressive vocabulary and initiation; as scores increased in expressive vocabulary there tended to be a decrease in initiation scores (more instances of inappropriate initiation), ($r = .304$, $p = .108$). Increases in PEDI score (more difficulties) were related to decreases in understanding of context ($r = .308$, $p = .104$) and an increase in SDQ prosocial score was related with an increase in understanding of context ($r = .335$, $p = .075$).

Discussion

This study explored the pragmatic profile in a group of six-year-old children with DS, specifically assessing the areas of initiation, scripted language, context and nonverbal communication, via the CCC-2 (Bishop, 2003), and comparing their performance to norms for

TD children. Relationships between these pragmatic subscales and the linguistic subscales of the CCC-2 were investigated. Additionally, the extent to which variance in these different areas of pragmatic communication was related to vocabulary, nonverbal cognitive ability and social functioning was explored.

Pragmatic communication in children with DS relative to norms for TD children

For each subscale of pragmatics in the CCC-2, the six-year-old children with DS obtained standardized scores more than 1 SD below the TD norm for children of the same age. After standardizing scores on the basis of MA, the children with DS fell at or below 1 SD of the TD norms for all subscales apart from nonverbal communication. When comparing the overall distribution of scores for each subscale for the children with DS to that of the mean of the established TD norms, performance on all pragmatic subscales were significantly poorer in the children with DS. Thus, six-year-old children with DS do not tend to perform at age-appropriate levels on any of the four pragmatic subscales measured here. Of course, individuals with DS tend to have a MA lower than their TD peers (Carr, 1985; Fidler, 2005), however the scores for the children with DS remained significantly poorer than the norms of TD children of similar MA (i.e., younger TD children) for each pragmatic subscale, providing an indication that pragmatics is not in line with nonverbal MA in children with DS, and is almost certainly not spared.

Pragmatic profile in children with Down syndrome

It is clear that relative to norms for TD children, scores for six-year-olds with DS were particularly impaired on the context subscale, and relatively less impaired for the nonverbal communication subscale, reflecting a profile of relative strengths and weaknesses across the different pragmatic subscales in the children with DS. Difficulties with use of context may lead children with DS to misunderstand the meanings of sentences in some contexts, and affect their ability to express themselves appropriately in new settings with new people; this may be

problematic when they are faced with new contexts upon entering school. The evidence of difficulties in the area of context in those with DS is in line with the findings of Laws and Bishop (2004), who observed that scores of individuals with DS on the context subscale of the original CCC were significantly poorer than much younger TD controls. The individuals with DS in the Laws and Bishop study were between the ages of 10 and 22. Our findings highlight that from as young as the age of six there is already a clear impairment present in children with DS in the area of context. For children with DS, it is possible that their opportunities to gain pragmatic experience are limited by other aspects of their condition, e.g., potential time spent out of school for other health complications (Turner, Sloper, Cunningham, & Knussen, 1990) and time spent separated from their peers due to receiving one-to-one teaching support (Fox, Farrell, & Davis, 2004). As the individuals reported by Laws and Bishop were older, we can assume that the early difficulties we have observed in the area of context may well remain even as children get older.

In contrast nonverbal communication appeared to be a strength overall relative to all three other pragmatic subscales in these young children with DS. This fits with previous findings (Franco & Wishart, 1995; John & Mervis, 2010; Mundy et al., 1988). However, although nonverbal pragmatic communication is a strength relative to these children's other communication abilities, the level of performance of the children with DS on the nonverbal communication subscale was nonetheless significantly below the norms for TD children even when adjusted for MA. In previous studies nonverbal communication in those with DS has been found to be in line with or better than MA-matched TD groups (Franco & Wishart, 1995; Mundy et al., 1988), however, an important difference between these studies and our study may be the age of the children. For instance, the children in the studies by Franco and Wishart (1995) and Mundy et al. (1988) were ages 21-47 months and ages 18-48 months respectively, thus it may be that nonverbal communication is in line with or better than MA in preschool children with

DS. However, by the age of six the gap begins to widen between the abilities of children with DS and their peers in terms of nonverbal communication ability. Fidler, Barrett and Most (2005b) found that younger children smiled more frequently than older children with DS, thus our findings may indicate that nonverbal communication abilites more generally are subject to age-related change in children with DS.

When children start school there is a greater demand on their pragmatic skills, as they are placed in new settings with many new people. The shift in demands when starting school may be challenging for children with DS, leading to a gap between those with DS and their peers. Another possibility is that differences in task type lead to different results, such that assessing one particular nonverbal communication behaviour in a lab setting may lead to greater performance than may be rated by parents who observe the child's various nonverbal communication behaviours on a day to day basis (as noted by Bishop, 1998). Parents provide ratings on a mixture of nonverbal behaviours, and indeed there were some items contributing to the overall nonverbal communication subscale for which no or very few problems were observed in the six-year-olds with DS, such as for items involving showing appropriate facial expression and recognising peoples' emotions. While nonverbal communication is clearly a relative communication strength in DS, children with DS entering the early school years are already beginning to experience some difficulty in this area relative to their TD peers. It is important that educators are aware of such difficulties, particularly as some nonverbal communication difficulties may be misinterpreted as poor behaviour, such as not looking at the teacher.

There was no significant difference in the degree of impairment seen on the scripted language subscale and the initiation subscale. Given that the six-year-old children with DS had significantly poorer scores on both of these subscales relative to their TD peers, it appears that children with DS in this age group are tending to use scripted language, such as saying things

they do not fully understand, and they are tending to show inappropriate initiation behaviours such as telling the listener information that they already know. Use of scripted language and inappropriate initiation, along with the difficulties involving context and nonverbal communication, are likely to impact children's ability to communicate effectively in the early school years (Bishop & Adams, 1989). Difficulties communicating effectively are in turn likely to affect social relationships and self-esteem as children develop (Hartup, 1983; Hemphill & Siperstein, 1990; Leary, Tambor, Terdal, & Downs, 1995; Place & Becker, 1991).

Linguistics vs. pragmatics

Although all aspects of pragmatics were impaired relative to the norms for TD children in these six-year-old children with DS, their overall mean scores across the combined pragmatic subscales were significantly stronger than their overall scores across the combined linguistic subscales of the CCC-2. Thus, as previously suggested by Roberts et al. (2007) structural language difficulties are more pronounced than pragmatic language difficulties in those with DS, and our findings show that this is the case in children with DS at the age of six. While it is clear that children with DS need a large degree of support in developing their structural language skills, the support also needed for pragmatic components of language skill must not be overlooked.

Relationships among subscales

The only significant correlation among pragmatic subscales was between scripted language and context, where higher context scores, i.e., *fewer* difficulties understanding context, were positively related to higher scripted language scores, i.e., *fewer* difficulties (less use of scripted language). It may be that instances of scripted language in part reflect difficulties understanding context. For instance, a child may misunderstand that a given phrase was appropriate in the original context, but is inappropriate to repeat in a different context. Scripted language difficulties were however much rarer than difficulties understanding context, thus,

other components of the scripted language subscale may make this behaviour much less likely to occur.

Significant correlations were observed between semantics and scripted language, coherence and scripted language, and syntax and context. Thus, both increases in semantics scores (i.e., understanding of meanings) and coherence were related to less use of scripted language. Scripted language involves behaviours such as the child repeating phrases that he/she does not understand the meaning of, it therefore seems appropriate that this correlates with children's scores on the semantic subscale, as knowing the meaning of a word (semantics) involves understanding how and when to use it. With regards to coherence, children who make more appropriate use of language, such as not repeating a scripted phrase in a new inappropriate context, may well appear more coherent (Reichman, 1978). Of course, this is only a correlational finding and the directions of these effects could therefore run either way. The only remaining significant correlation was between syntax and context. Syntax is an area of particular difficulty in DS (Fowler, 1990), and context was an area of particular pragmatic difficulty in these children with DS. Although we must emphasise that our findings are not causative, questions contributing to the context subscale such as 'taking in just one or two words in a sentence, leading to misinterpretation', or 'missing the point of verbal jokes' could quite feasibly be influenced by poor syntax. We would suggest future research should explore whether the particular difficulties in syntax in individuals with DS cause difficulties in pragmatic communication such as use of context, as well as exploring the extent to which difficulties in semantics and coherency may cause pragmatic difficulties in children with DS.

Relationships between Pragmatics, Vocabulary, Nonverbal cognitive ability and Social functioning

None of the expected correlations involving either vocabulary, nonverbal cognitive ability or social functioning and pragmatic difficulties in children with DS survived statistical correction;

this may be due to a lack of power. There were no correlations of large effect size involving these variables.

However a number of the correlations not surviving statistical correction were of medium effect size and may therefore warrant future research. For example, the correlations between measures of social functioning and areas of pragmatics (initiation, scripted language and context subscales) may be worth exploring further in children with DS given that very similar findings are observed in TD groups (Bignell & Cain, 2007; Farmer & Oliver, 2005; Green et al., 2014; Mackie & Law, 2010).

Limitations

The limitations of this study do also need to be acknowledged. Though our original sample was larger than the sample sizes typically used in this area, the original sample size was reduced somewhat as some children had to be excluded as a result of not being able to speak in sentences. However, we would argue that this weakness is offset by the benefit of obtaining data on pragmatics in children with DS in the first grade of mainstream schooling, allowing us to show that a pattern of strengths and weaknesses appears early on in this population.

It was not possible to use all children's exact MA's to obtain standardized scores on the basis of MA. Rather, the lowest CCC-2 TD norms table (Age 4 years, 0 months – 4 years, 2 months) was used to derive standardized scores for any children with DS with a MA lower than age 4. However, this still allows for all of the children to obtain higher standardized scores much closer to the their MA equivalent than we see when using the CA based standardized scores (i.e., standardizing scores on the basis of norms for 6 year old TD children), thus providing an indication of whether DS children's pragmatic communication is in line with TD norms for children of a similar MA.

It is also important to acknowledge that the CCC-2 is a subjective parental report measure and there is thus the possibility of subjective bias in parental responses. However,

given the limitations regarding traditional tests of pragmatics (as noted in the Introduction), this was the most suitable available measure for our purposes.

Summary

On all pragmatic subscales of the CCC-2, standardized scores for the group of children with DS were significantly poorer than TD norms (CA equivalent, and when adjusted to account for MA). Thus, the current study extends previous work on samples with wider age ranges, in showing that pragmatic communication in children with DS at age 6 is not spared and is subject to some areas of particular weakness. Nonverbal communication was a *relative* strength for children with DS in this study. Understanding context was the area in which significantly more difficulties were reported relative to the other areas of pragmatic difficulty. Scores on the context subscale for these children with DS were related to a number of other areas of potential difficulty (e.g., syntax, semantics, social functioning), these other related areas of difficulty are suggested for future research to explore the extent to which they may play a role in pragmatic communication, and particularly the area of context.

While it is of course crucial that children are taught structural language skills, the current study shows that we must not take for granted that children with DS know how and when to use and apply the language knowledge that they are taught. This study clearly shows that by the age of 6 children with DS already struggle with pragmatic communication, with a clear profile at this age. Future research should be carried out to explore the extent to which pragmatic communication can be enhanced in children with DS to bring them closer in line with peers. Given the role of successful communication for children's development, it is crucial that as well as linguistic aspects of communication, skills associated with pragmatic communication are targeted in this population, both in the classroom and in training.

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Appendix

Appendix A. Table of means, standard deviation and range for each subscale of the CCC-2 for children with DS when scores were standardized on the basis of mental age.

Mental age standardized score

CCC2 Subscales:	***M***	***SD***	**Range (Min – Max)**
A. Speech	2.59	2.54	0-8
B. Syntax	1.76	2.28	0-9
C. Semantics	5.61	1.83	3-9
D. Coherence	5.39	2.17	2-12
E. Initiation	6.90	1.45	5-11
F. Scripted language	6.96	2.69	3-14
G. Context	5.10	1.68	2-8
H. Nonverbal communication	7.66	1.49	4-10
I. Social relations	5.96	2.60	0-10
J. Interests	6.31	1.83	4-11

Note. Due to missing responses, N = 28 for subscale F (scripted language), subscale C (Semantics), subscale D (Coherence) and subscale I (Social Relations). For all remaining subscales N = 29. TD standard scores for each of the subscales of the CCC2 had a normative mean of 10 (SD = 3).

Appendix B. Correlations

Table 2. Correlations for the pragmatic subscales of the CCC-2

	Initiation *r (p)*	*Scripted Language* *r (p)*	*Context* *r (p)*	*Non-verbal Communication* *r (p)*
Initiation		.350 (.068)	.269 (.159)	.100 (.605)
Scripted Language			.559 (.002)	.081 (.681)
Context				.178 (.356)
Non-verbal Communication				

Table 3. Correlations for the pragmatic and the linguistic subscales of the CCC-2

	Initiation *r (p)*	*Scripted Language* *r (p)*	*Context* *r (p)*	*Non-verbal Communication* *r (p)*
Speech	-.021 (.912)	.137 (.488)	.271 (.156)	.064 (.742)
Syntax	.149 (.441)	.242 (.215)	.468 (.010)	.037 (.850)
Semantics	.025 (.896)	.547 (.003)	.377 (.044)	-.137 (.479)
Coherence	.271 (.155)	.621 (.001)	.375 (.045)	.045 (.816)

Table 4. Correlations for the pragmatic subscales of the CCC-2 and clinical tests.

	Inappropriate Initiation r (p)	*Scripted Language r (p)*	*Context r (p)*	*Nonverbal communication r (p)*
Expressive vocabulary	-.304 (.108)	.281 (.148)	.170 (.379)	-.116 (.548)
Receptive vocabulary	-.024 (.903)	.315 (.102)	-.065 (.737)	-.383 (.040)
Nonverbal ability	-.249 (.193)	.062 (.754)	-.079 (.685)	-.200 (.297)
PEDI	-.062 (.750)	.163 (.408)	-.308 (.104)	.053 (.787)
SDQ	-.429 (.020)	-.423 (.025)	-.294 (.122)	-.061 (.755)
SDQ pro social	.185 (.337)	.179 (.362)	.335 (.075)	.108 (.576)